

Amendments to the Claims:

The claims are as listed below with ~~striketrough~~ and double brackets ([[]]) indicating the deletion of text from the claims and underline indicating the insertion of text into the claims. This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Canceled) A method of communicating a plurality of signals that have been coherently multiplexed together over an optical link from a first site, the method comprising the steps of:

operating a light source unit to produce multiple mutually coherent outputs which are directed as optical signals into a plurality of optical paths comprising “N” signal paths and a reference path;

wherein each of the “N” signal paths form one of “N” signal arms of “N” interferometers and has a different path length than the other of the “N” signal paths, the reference path forms the reference path arm for each interferometer, and the path length difference of each interferometer is ΔL_i ;

receiving optical signals on each of the “N” signal paths at a modulator therein and modulating the received optical signals with data; and

combining the optical signals from each of the “N” signal paths and from the reference path to generate a combined optical signal that is transmitted on a single optical path, wherein each optical signal of the combined optical signal is respectively multiplexed in time relative to the other optical signals of the combined optical signal due at least in part to the propagation time delays caused by the path length differences of the signal arms of the interferometers, and wherein each optical signal of the combined optical signal has the same phase as the other optical signals of the combined optical signal.

2. (Canceled) The method of Claim 1, further comprising the steps of:

optically splitting the combined optical signal into “N” optical signals on “N” path pairs at a second site, wherein each path pair forms an interferometer with two inputs and two outputs, and the path length difference of each interferometer is $\Delta L_i'$, and

coherently demultiplexing each of the “N” optical signals to retrieve the data through differential detection of the two outputs of each interferometer.

3. (Canceled) The method of Claim 1, wherein the light source unit comprises a phase locked laser diode array.
4. (Canceled) The method of Claim 3, wherein the light source unit includes an imaging system.
5. (Canceled) The method of Claim 4, wherein the imaging system comprises a microlens array.
6. (Canceled) The method of Claim 4, wherein the imaging system comprises a cylindrical lens.
7. (Canceled) The method of Claim 1, wherein the light source unit comprises a phase locked light-emitting diode array.
8. (Canceled) The method of Claim 7, wherein the light source unit includes an imaging system.
9. (Canceled) The method of Claim 1, wherein the light source unit produces a singular output that is imaged into multiple optical fibers by use of wavefront splitting.
10. (Canceled) The method of Claim 1, wherein the light source unit produces a singular output which is imaged into multiple integrated optical waveguide channels by an imaging system.
11. (Canceled) The method of Claim 10, wherein the imaging system comprises a microlens array.

12. (Canceled) The method of Claim 10, wherein the imaging system comprises a cylindrical lens.
13. (Canceled) The method of Claim 1, wherein the light source unit comprises a single source that feeds a 1x2 coupler, one output of the coupler feeds a common reference path (r) for "N" interferometers and the other output of the coupler feeds a 1xN splitter that feeds "N" signal paths comprising the second arms of the "N" interferometers.
14. (Canceled) The method of Claim 13, wherein "N" is greater than or equal to 3.
15. (Canceled) The method of Claim 1, wherein an optical signal directed into the reference path has a reference frequency, and wherein a frequency modulator is placed in the reference path to shift the reference frequency.
16. (Canceled) The method of Claim 1, wherein the path length differences of each of the "N" interferometers is proportional to the coherence length of the light source used to generate the optical signals on each of the "N" signal paths and the normalized separation relative to the optical path length between the optical signal path of the first interferometer and the reference path.
17. (Canceled) The method of Claim 1, wherein the modulator uses amplitude (ASK) modulation.
18. (Canceled) The method of Claim 1, wherein the modulator uses phase (PSK) modulation.
19. (Canceled) The method of Claim 1, wherein the modulator uses frequency (FSK) modulation.

20. (Canceled) A method of communicating a plurality of optical signals over an optical link from a first site, the method comprising the steps of:

generating a first plurality of optical signals modulated with data, wherein each optical signal of the first plurality of optical signals has a same first wavelength and same phase;

delaying optical signals of the first plurality of optical signals in time relative to the other optical signals of the first plurality of optical signals;

receiving each optical signal of the first plurality of optical signals at a first combiner at a different time relative to the other optical signals of the first plurality of optical signals;

combining the optical signals of the first plurality of optical signals at the first combiner to produce a first coherence multiplexed optical signal including optical signals of the first plurality of optical signals offset in time relative to the other optical signals of the first plurality of optical signals;

generating a second plurality of optical signals modulated with data, wherein each optical signal of the second plurality of optical signals has a same second wavelength and same phase, and wherein the second wavelength is different than the first wavelength of the optical signals of the first plurality of optical signals;

delaying optical signals of the second plurality of optical signals in time relative to the other optical signals of the second plurality of optical signals;

receiving each optical signal of the second plurality of optical signals at a second combiner at a different time relative to the other optical signals of the second plurality of optical signals;

combining the optical signals of the second plurality of optical signals at the second combiner to produce a second coherence multiplexed optical signal including optical signals of the second plurality of optical signals offset in time relative to the other optical signals of the second plurality of optical signals;

multiplexing at the first site the first coherence multiplexed optical signal and the second coherence multiplexed optical signal to produce a single wavelength division multiplexed optical signal; and,

optically transmitting the wavelength division multiplexed optical signal to a second site.

21. (Canceled) The method of Claim 20, wherein the wavelength division multiplexed optical signal comprises a dense wavelength division multiplexed optical signal.

22. (Canceled) The method of Claim 20, further comprising the steps of:

receiving at a second site the wavelength division multiplexed optical signal;

demultiplexing at the second site the received wavelength division multiplexed optical signal into the first coherence multiplexed optical signal and the second coherence multiplexed optical signal, and

directing at least one of the first coherence multiplexed optical signal and the second coherence multiplexed optical signal to a coherence demultiplexing unit.

23. (Canceled) The method of Claim 22, wherein the step of demultiplexing includes dense wavelength division demultiplexing.

24. (Canceled) The method of Claim 20, further comprising the step of spectrally slicing the output of a broadband light source into a first output having the first wavelength and a second output having the second wavelength, wherein the first and second wavelengths comprise different wavelengths.

25. (Canceled) The method of Claim 24, wherein the broadband light source comprises a mode-locked laser source.

26. (Canceled) The method of Claim 24, wherein the broadband light source comprises a fiber amplifier.

27. (Canceled) The method of Claim 24, wherein the broadband light source comprises an amplified spontaneous emission source.

28. (Canceled) The method of Claim 24, wherein the step of spectrally slicing comprises wavelength division demultiplexing.

29. (Canceled) A method of receiving a plurality of optical signals that have been coherently multiplexed together and transmitted over an optical link from a first site to a second site, the method comprising the steps of:

receiving an optical signal including a first coherently multiplexed optical signal and a second coherently multiplexed optical signal, wherein the first coherently multiplexed optical signal includes a first optical signal offset in time relative to a second optical signal and having the same phase as the second optical signal, and wherein the second coherently multiplexed optical signal includes a third optical signal offset in time relative to a fourth optical signal and having the same phase as the fourth optical signal;

wavelength division demultiplexing the received optical signal into the first coherently multiplexed optical signal and the second coherently multiplexed optical signal;

optically splitting the the first coherently multiplexed optical signal into optical signals on first and second path pairs, wherein a single path pair forms an interferometer comprising an optical signal path and a reference path having different path lengths ($\Delta L_i'$); and

coherently demultiplexing the first coherently multiplexed optical signal into the first and second optical signals.

30. (Canceled) The method of Claim 29, wherein the step of coherently demultiplexing is performed using a coherence demultiplexer at the second site matched to a coherence multiplexer at the first site so that $|\Delta L_i - \Delta L_i'| < L_{\text{coh}}$.

31. (Canceled) The method of Claim 30, wherein optical signals on the optical signal paths of the first and second path pairs are separated in path length from each other by a distance of at least the numerical product of the coherence length of the light source used to generate the optical signals and the normalized separation relative to the optical path length between the optical signal path of the first path pair and the reference path.

32. (Canceled) The method of Claim 29, wherein the step of coherently demultiplexing employs homodyne reception and active path length stabilization.

33. (Currently Amended) ~~The method of Claim 29,~~ A method of receiving a plurality of optical signals that have been coherently multiplexed together and transmitted over an optical link from a first site to a second site, the method comprising the steps of:

receiving an optical signal including a first coherently multiplexed optical signal and a second coherently multiplexed optical signal, wherein the first coherently multiplexed optical signal includes a first optical signal offset in time relative to a second optical signal and having the same phase as the second optical signal, and wherein the second coherently multiplexed optical signal includes a third optical signal offset in time relative to a fourth optical signal and having the same phase as the fourth optical signal;

wavelength division demultiplexing the received optical signal into the first coherently multiplexed optical signal and the second coherently multiplexed optical signal;

optically splitting the first coherently multiplexed optical signal into optical signals on first and second path pairs, wherein a single path pair forms an interferometer comprising an optical signal path and a reference path having different path lengths (ΔL_i); and

coherently demultiplexing the first coherently multiplexed optical signal into the first and second optical signals;

wherein the step of coherently demultiplexing includes polarization splitting of the first coherently multiplexed optical signal allowing the polarized signals to be directed to two separate demultiplexing interferometers.

34. (Canceled) The method of Claim 29, wherein the step of coherently demultiplexing is performed using a coherence demultiplexer having a coherence receiver and an active polarization adjuster with feedback that communicates with the coherence receiver.

35. (Canceled) The method of Claim 29, wherein the step of coherently demultiplexing is performed using a coherence demultiplexer having an interferometer with an active polarization adjuster with feedback in one path of the interferometer.

36. (Canceled) The method of Claim 29, wherein the step of coherently demultiplexing is performed using a coherence demultiplexer having an interferometer with a frequency modulator in one path of the interferometer.

37. (Canceled) The method of Claim 29, wherein the step of coherently demultiplexing is performed using a coherence demultiplexer employing heterodyne reception.

38. (Canceled) The method of Claim 37, wherein the step of coherently demultiplexing is performed using a coherence demultiplexer having an interferometer with active path length stabilization being useable on one of the paths of the interferometer.

39. (Canceled) A method of communicating a plurality of optical signals over an optical link from a first site to a second site, the method comprising the steps of:

optically multiplexing a plurality of output optical signals to form a multiplexed optical signal at a first site, wherein each output optical signal of the plurality of output optical signals includes a coherently multiplexed plurality of modulated optical signals that are offset in time relative to one another, and wherein each of the modulated optical signals has the same wavelength and the same phase;

communicating the multiplexed signal;

optically demultiplexing the multiplexed signal at a second site into a plurality of optically demultiplexed signals;

delivering the plurality of optically demultiplexed signals to at least one coherence demultiplexer;

optically splitting the plurality of optically demultiplexed signals into a plurality of optical signals on a plurality of path pairs, wherein a single path pair forms an interferometer

including two arms having different path lengths ($\Delta L_i'$), and wherein the two arms include a signal path carrying a data signal and a reference path carrying a reference signal;

recombining the data signal and the reference signal to produce a recombined signal; and

communicating the recombined signal to a coherence receiver having two light source detectors connected to a differential amplifier.

40. (Canceled) The method of Claim 39, wherein the at least one coherence demultiplexer is matched to a coherence multiplexer that produces the output optical signals of the plurality of output optical signals so that $|\Delta L_i - \Delta L_i'| < L_{\text{coh}}$.

41. (Canceled) The method of Claim 40, wherein the optical signals on the signal path and the reference path are separated in path length from each other by a distance of at least the numerical product of the coherence length of the light source used to generate the optical signals and the normalized separation relative to the path length between the signal path of a first path pair and the reference path.

42. (Canceled) The method of Claim 39, wherein the at least one coherence demultiplexer includes a coherence receiver using homodyne reception and active path length stabilization.

43. (Currently Amended) ~~The method of Claim 39,~~ A method of communicating a plurality of optical signals over an optical link from a first site to a second site, the method comprising the steps of:

optically multiplexing a plurality of output optical signals to form a multiplexed optical signal at a first site, wherein each output optical signal of the plurality of output optical signals includes a coherently multiplexed plurality of modulated optical signals that are offset in time relative to one another, and wherein each of the modulated optical signals has the same wavelength and the same phase;

communicating the multiplexed signal;

optically demultiplexing the multiplexed signal at a second site into a plurality of optically demultiplexed signals;

delivering the plurality of optically demultiplexed signals to at least one coherence demultiplexer;

optically splitting the plurality of optically demultiplexed signals into a plurality of optical signals on a plurality of path pairs, wherein a single path pair forms an interferometer including two arms having different path lengths (ΔL_i '), and wherein the two arms include a signal path carrying a data signal and a reference path carrying a reference signal;

recombining the data signal and the reference signal to produce a recombined signal; and

communicating the recombined signal to a coherence receiver having two light source detectors connected to a differential amplifier;

wherein the step of optically splitting includes polarization splitting of each of the optically demultiplexed signals of the plurality of optically demultiplexed signals.

44. (Canceled) The method of Claim 39, further comprising a step of adjusting the polarity of the reference signal with an active polarization adjuster using feedback.

45. (Canceled) The method of Claim 39, wherein an active polarization adjuster with feedback exists in one path of each interferometer.

46. (Canceled) The method of Claim 39, wherein a frequency modulator is present in one path of each interferometer.

47. (Canceled) The method of Claim 39, wherein the coherence receiver uses heterodyne reception.

48. (Canceled) The method of Claim 47, wherein active path length stabilization is used in one of the paths of the interferometer.

49. (Canceled) The method of Claim 39, further comprising a step of dropping a plurality of coherence multiplexed signals.